130 Volt

WARREN COMMUNICATIONS

DIVISION OF SOLA BASIC INDUSTRIES

INSTRUCTION MANUAL

WARREN COMMUNICATIONS
DIVISION OF SOLA BASIC INDUSTRIES
LITTLETON, MASSACHUSETTS 01460 • 617—486-3575

INSTRUCTION MANUAL

WARREN

POWER SUPPLY

MODEL NO(S)

130 PS 2

SHOP ORDER No.
6305-36

WARREN COMMUNICATIONS
Division of Sola Basic Industries

Littleton, Massachusetts

Littleton	Area 617-486-3575
Boston	Area 617-542-6960
TWX	Area 710-347-0650

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SECTION I

INTRODUCTION

1-1. This manual provides the necessary instructions for the operation and service of the AC to DC Power Supply (PS) manufactured by the Warren Manufacturing Company, Littleton, Massachusetts.

1-2. The power supply provides a regulated 130 VDC output and is designed such that either the positive or negative output may be grounded. This unit employs non-aging silicon diode rectifiers, conservatively rated for trouble-free operation.

SECTION II

SPECIFICATIONS

2-1. ELECTRICAL

INPUT

Voltage: 120 ±10% VAC
Current: 3.5 Amps maximum at full load
Frequency: 47-63 Cps Single Phase

OUTPUT

Voltage: 130 ± 5 VDC
Current: 2 Amps
Regulation: ± 5% total from 10 to 100% load, ± 10% input voltage variation, 47 to 63 cps, and 0 to 40°C ambient temperature change.
Filtering: 200 MV RMS Maximum

2-2. MECHANICAL

Cabinet: 7" High x 10-5/8" Deep x 23" Wide Overall
Weight: 50 Lbs Net, 60 Lbs Shipping
Finish: Telephone Gray Baked Enamel

2-3. FEATURES

A. Input and Output fused for overload protection.

B. Input disconnect provided by means of a DPDT switch.

C. Rheostat provided for output voltage adjustment.

D. Jacks provided for monitoring output voltage.

SECTION III

INSTALLATION AND OPERATION

3-1. INSTALLATION.

A. Carefully locate and install the Power Supply in the relay rack.

NOTE: In locating the Power Supply, it is important that at least 6 inches of clearance be provided above and below the unit to give adequate ventilation.

B. Open the front door which is secured with (2) camloc fasteners on the top edge. Locate the TB1 terminal board which is in the right rear corner.

C. Connect the external wiring to TB1 as shown in Figure 3-1, Connection Diagram, and the following instructions.

CAUTION: TO PREVENT DAMAGE TO THE UNIT, CHECK THE POLARITY OF THE DC LEADS BEFORE CONNECTING TO THE DC TERMINALS.

1. Connect the + - AC and AC GND terminals to the AC input.
2. Connect the DC - terminal to the negative (-) side of the load.
3. Connect the DC + terminal to the positive (+) side of the load.
4. Connect the CAB GND terminal to ground.

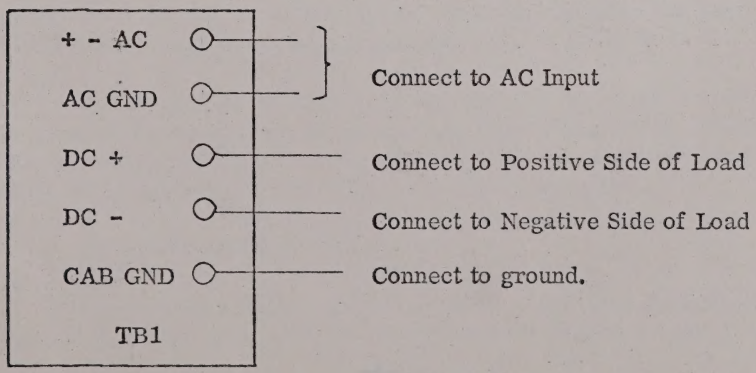


FIGURE 3-1. CONNECTION DIAGRAM

3-2. OPERATION.

A. After the above installation procedure, the Power Supply is ready for operation. All adjustments have been factory set and normally do not require changing in the field, but should some adjustment be desired, refer to paragraph 3-3.

B. To energize the Power Supply, place the INPUT SWITCH, S1, in the ON position.

3-3. CONTROLS.

A. The INPUT SWITCH, S1, controls the AC input to the Power Supply.

B. The ANTI-HUNT rheostat, R103, is provided to adjust the gain of the preamplifier circuit. Increasing the resistance of this rheostat reduces any hunting tendency of the unit.

C. The DC-LOAD VOLTS rheostat, R100, is provided to adjust the DC output voltage.

D. The CLAMP VOLTS rheostat, R102, is provided to adjust the point at which the output voltage is clamped.

SECTION IV

THEORY OF OPERATION

4-1. GENERAL.

This section is divided into the various circuits involved in the operation of the Power Supply. Refer to the Schematic Diagrams contained in Section VII.

4-2. POWER CIRCUIT.

The AC input voltage is impressed upon the primary of the power transformer, TR1, through switch S1 and input fuse F1.

The power transformer, TR1, isolates the AC and DC circuits and changes the AC input voltage to a value usable in the power rectifier circuit. The secondary of TR1 feeds a controllable full-wave rectifier bridge of D1A, D1B, SCR1A, and SCR1B.

The output of the rectifier bridge is filtered by L1, C1, and RB.

4-3. THE SCR FIRING CIRCUIT.

TR100 is across the AC input and supplies voltage for the SCR Firing circuit.

TR100 voltage is fed to the magnetic amplifier MA100 anode windings 5-8, 6-9 in series with the primary winding 1-2 of the Pulse Transformer TR800. Prior to the time the magnetic amplifier becomes saturated, virtually all the circuit voltage is impressed across the magnetic amplifier anodes. When the magnetic amplifier saturates, or fires, the circuit voltage is impressed across the primary of TR800.

Pulse transformer, TR800, has two secondary windings. As TR800 fires on each alternate half-cycle of AC, the AC pulse is rectified and placed between the gate and cathode of the SCR in such a manner that the signal on the gate is always positive with reference to the signal on the cathode.

The firing point of MA100 determines the DC output voltage. This firing point is controlled by current in the control windings 1-4 and 2-3. The current through the control windings is in turn, controlled by the preamplifier circuit. Control winding 11-12 is shorted to stabilize closed loop operation.

4-4. PREAMPLIFIER CIRCUIT.

Zener Diodes D105 and D106 provide a reference voltage for load voltage comparisons. Resistor R105 is in series with the zeners across the load voltage.

Little current flows and essentially all the load voltage is across the zeners below "zener breakdown" voltage. Above this, the increase in voltage is absorbed by R105 while the zener voltage remains constant.

Transistors Q101 and Q102 are voltage regulator PNP transistors which control the current in the magamp coils 2-3 and 1-4 respectively.

Resistors R108, R100, and R109 form a voltage divider across the load. The voltage from the arm of R100 through R109 is proportional to load voltage, its quiescent value approximately equals zener voltage. The quiescent voltage from the arm of R100 through R108 approximately equals R105 voltage.

Resistor combination R104 and R106 determine the transistor current level. Resistors R115, R116 and Rheostat R103 provide an anti-hunt adjustment network by making possible an adjustment in the closed-loop system gain (or sensitivity). When R103 is shorted out, R115 and R116 in parallel, are essentially in series with R104 and R106. When R103 is completely unshorted, R115 becomes a degenerating emitter resistor for Q102 and R116 for Q101. As the degenerating resistance increases, the accuracy with which the system can maintain constant voltage decreases, and the tendency to oscillate decreases.

Resistor R114 works in conjunction with the High Voltage Clamp circuit. It provides a higher resistance path, in the event Q102 was shorted, so that Q100 could supply most of the transistor sum current to winding 2-3 of the magamps to lower the output voltage.

Accurate error-voltage sensing is possible because Q101 and Q102 collector currents have a constant sum. The zener diodes hold the Q102 base potential constant. The R104, R106 combination voltage approximately equals zener voltage, which also appears from the arm of R100 through R109. Since the R100, R109 voltage is proportional to load voltage, balanced collector currents occur at only one value of regulated DC voltage.

Below balance, R100 and R109 voltage lowers proportionately with the output voltage. With Q101 emitter potential held constant by a fixed R104, R106, R116, and R103 combination current, Q101 base becomes less negative (or more positive) than the Q101 emitter. This tends to turn Q101 off. As Q101 turns off, Q102 must turn on an equal amount. When Q101 turns completely off, Q102 turns and remains full on for lower load voltages.

Above balance, Q101 base becomes more negative than the Q101 emitter. This turns Q101 on, and Q102 off by equal amounts. With Q102 full off, Q101 current increases with larger load voltages, while Q102 is held off by the zener.

4-5. HIGH VOLTAGE CLAMP CIRCUIT.

Transistor Q100 is connected in parallel across Q101 and its emitter resistor R116. Resistors R111, R112, and R102 form a voltage divider across the sensing circuit. R102 is a potentiometer whose arm is connected to base of Q100. The setting of R102 determines the operating level of the circuit.

As the output voltage increases, the voltage on the base of Q100 increases. At some level of output voltage, determined by the setting of R102, the base of Q100 will become negative with respect to its emitter and Q100 will conduct current. When Q100 conducts, a "lower" signal is fed to the magnetic amplifier and a reduction of output voltage will result.

SECTION V

MAINTENANCE AND REPAIR

5-1. MAINTENANCE.

The Power Supply is a static device and requires no periodic maintenance except for an occasional cleaning to remove any accumulation of dust and any foreign particles which might impair its performance.

5-2. REPAIR.

The repair procedures in this manual are divided into two parts. First, the trouble shooting section to determine the cause of any malfunction, and second, the repair or replacement procedures which contain any special procedures necessary to restore service after the cause of the malfunction has been determined.

5-3. PRELIMINARY TROUBLE SHOOTING.

A. Visually inspect the unit for obvious troubles, such as: blown fuses, improper setting of Input switch, burned or charred components, broken or shorted leads and connections, etc.

B. Check the input and output for proper values, excessive resistance in the leads, etc.

C. If unable to determine the cause of the malfunction with the above procedure, proceed to the Trouble Shooting Table.

CAUTION: TO PREVENT FURTHER DAMAGE, ALWAYS DE-ENERGIZE A DEFECTIVE UNIT COMPLETELY UNLESS IN THE PROCESS OF TROUBLE SHOOTING. MAKE CERTAIN THAT THERE IS NO POSSIBLE INPUT TO THE UNIT, EITHER AC OR DC.

5-4. TROUBLE SHOOTING TABLE.

Table 5-1 lists specific failure conditions, the possible cause and the remedy. If unable to restore normal operation by using this table, contact the Service Department of Warren Manufacturing Company, Littleton, Massachusetts.

NOTE: In order to provide faster service when requesting assistance from the Warren Manufacturing Co., please supply all the data given on the name plate for the applicable unit in addition to all symptoms of the malfunction and any action already taken to correct it.

TABLE 5-1
TROUBLE SHOOTING

TROUBLE	POSSIBLE CAUSE	REMEDY
1. Recurrent AC Fuse failure.	a. Defective power circuit component.	a) Test in accordance with Test #1 of Trouble Shooting Test Procedure.
	b. Defective Pulse Transformer TR800.	a) Jumper terminals 1 & 2 of TR800. If fuse doesn't blow, replace TR800. If fuse does blow, check all wiring.
2. High or Low output.	a. Defective TB100 Board.	a) Replace TB100 Board.
	b. Shorted SCR.	a) Test in accordance with Test #3 of Trouble Shooting Test Procedure and replace if necessary.
	c. Defective Pulse Transformer TR800.	a) Check as above.

5-5. TROUBLE SHOOTING TEST PROCEDURES.

The following test procedures are those referenced in the Trouble Shooting Table for isolating the cause of a malfunction.

TEST #1.

In the following table, remove the AC supply before removing any connection(s) and reapply after removal of the connection(s). Before proceeding to the next step, reconnect the Lead(s) unless otherwise noted.

TEST #1 (Cont'd)

CONNECTIONS TO BE REMOVED	IF FUSE BLOWS	IF FUSE DOES NOT BLOW
1. (-) on Rectifier Assy. (Self-lead from L1-2 to TR1-R10 on Diode Assy.	Proceed to Step 2.	Proceed to Step 4.
2. TR1-3 & 4 on Diode Assy.	Proceed to Step 3.	Check for defective SCR or diode and replace as necessary.
3. TR1-2 on Diode Assy. Wht-Brn lead TB100-11, Wht-Blk lead TB100-10.	Replace TR1.	Replace TR800 or TB100 as necessary.
4. Self-lead from L1-1 to C1 (-).	Replace L1.	Proceed to Step 5.
5. Wht-Red leads on C1(-).	Replace C1.	Proceed to Step 6.
6. Wht-Red lead from C1(-) to RB.	Trace all wiring for defects.	Replace RB.

TEST #2. TEST FOR A SHORTED DIODE.

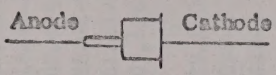
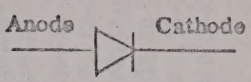
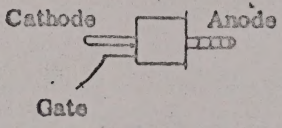
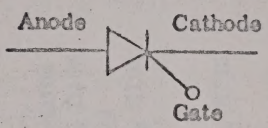
Completely disconnect the diode from the circuit and measure the resistance. Reverse the meter leads and measure again. If a diode is shorted, it will have the same ohmmeter reading when the leads are reversed.

TEST #3. TEST FOR A SHORTED SCR.

Completely disconnect the SCR from the circuit. Place the ohmmeter on the RX 10,000 scale. Measure from anode to cathode for at least 50,000 ohms. Reverse the leads and measure again for at least 50,000 ohms. A reading below 50,000 ohms, in either direction, is indicative of a faulty SCR. To check the SCR gate, connect ohmmeter between gate and cathode terminals and check as a diode.

5-5. B. SEMICONDUCTORS.

FIGURE 5-1

PART	PICTORIAL REPRESENTATION	SCHEMATIC SYMBOL
DIODE		
SCR		

5-6. REPAIR OR REPLACEMENT PROCEDURES.

A. Replacement of SCR Diodes and Silicon Power Diodes.

1. When replacing a diode mounted on a heat sink, apply a thin layer of silicon grease (Dow Corning #5 or equivalent) to both sides of the heat sink. DO NOT lubricate the diode or the clearance hole on the heat sink. If diodes were insulated from heat sink be sure to install proper insulating washers when replacing the diodes.

Fasten the diode to the heat sink with the proper torque as set forth in Table 5-2 below.

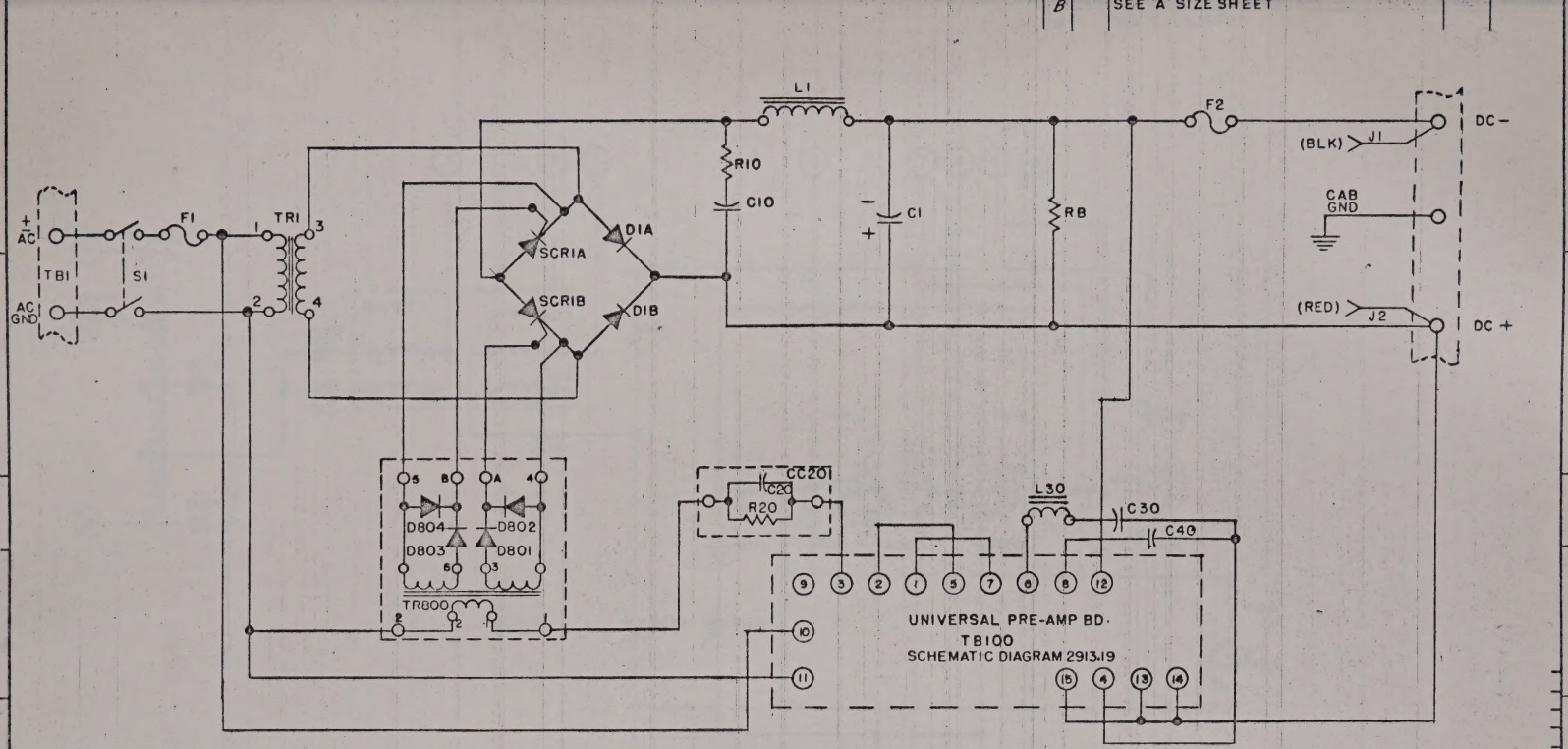
DIODE MOUNTING TORQUES

	DIODE STUD SIZE		TORQUE In. Lbs.		TORQUE Ft. Lbs.	
	Dia	Thds/In	Min to	Max	Min to	Max
DIODES	190	32	16	20	1.25	1.67
	1/4	28	20	30	1.67	2.50
	3/8	24	144	180	12	15
	1/2	20	360	480	30	40
	3/4	16	480	540	40	45
SCRS	190	32	14	16	1.17	1.25
	1/4	28	28	30	2.30	2.50
	1/2	20	140	150	11.7	12.5
	3/4	16	270	300	22.5	25
	1	12	540	600	45	50

Recommended Spares (See Note 1)								
Total Used in 130 PS 2								
-6	-5	-4	-3	-2	-1	ITEM	MFR'S PART NO.	REF. DESIG.	WARREN P/N
					1	Door & Component Assy.	Warren Mfg. Co.		2913.40-1
					1	Capacitor 11,000 Mfd, 10VDC	Sprague #36D1029K	C30	7000.618-3
					1	Capacitor & Lug Assy	Warren Mfg. Co.		2913.45-1
					1	Capacitor 500 Mfd 12 VDC	Sprague #TVA-1132	C40	7000.414-10
					1	Choke Assy	Warren Mfg. Co.	L30	2988.46-2
					1	Component Board Assy.	Warren Mfg. Co.	CC20	2941.21-2
					1	Capacitor 1 Mfd, 100VDC	Goodall 663UW Series	C20	7001.626-28
					1	Resistor 2.2K, 2W	IRC, Wirewound, Type BWH	R20	6029.100-12
		2			1	Fuse 5A, 125V	Buss MTH	F1	4.628-5
		2			1	Fuse 3A, 125V	Buss AGC	F2	4.628-4
					2	Fuseholder	Buss HKA-D		4.627-1
					1	Pinjack (Blk)	C. F. Johnson #105-603	J1	4.571-2
					1	Pinjack (Red)	C. F. Johnson #105-602	J2	4.571-1
		1			1	Pre-Amp Bd. Assy.	Warren Mfg. Co.	TB100	2913.15-1
					1	Diode	G. E. Z4XL20B	D100	9000.33-17
					4	Diode	Clevite 1N676	D101-D104	9009-6
					2	Diode	Transitron SV5	D105, D106	9002-1
					1	Mag Amp Assy.	Warren Mfg. CO.	MA100	2421.13-1
					2	Potentiometer 150Ω, 2W	Chicago Tel Type P-115	R100, R103	6032.15-2
					1	Potentiometer 500Ω, 2W	Chicago Tel Type P-115	R102	6032.15-5
					1	Potentiometer 1000Ω, 2W	Chicago Tel Type P-115	R104	6032.15-3
					2	Resistor 8000Ω, 3W	Ohmite, Axial Lead	R105, R112	6020.3-52
					7	Resistor 470Ω, 2W, ± 5%	IRC, Wirewound, Type BWH	R106, R107, R110, R111, R114-R116, ...	6029.200-80
					1	Resistor 5600Ω, 5W	Ohmite, Brown Devil	R108	6020.5-85
					1	Resistor 390Ω, 2W, ± 5%	IRC, Wirewound, Type BWH	R109	6029.200-78

NOTE 1. When ordering spare parts from the Warren Manufacturing Company, please include the Model No., Manufacturer's Part No. and Shop Order No. as shown on the name plate for the applicable unit.

Recommended Spares (See NOTE 1)								
Total Used in 130PS 2								
-6	-5	-4	-3	-2	-1	ITEM	MFR'S PART NO.	REF. DESIG.	WARREN P/N
					1	Resistor 3500Ω, 10W	Ohmite, Axial Lead	R113	6020.10-44
					1	Resistor 68K, 1W ± 10%	Allen Bradley, Type GB	R117	6024.11-54
					1	Transformer Assy.	Warren Mfg. Co.	TR100	2484.56-1
					3	Transistor	G.E. 2N241A	Q100-Q102	8000.3-1
					1	Switch DPDT	MIL Type ST52N	S1	4.138-1
					1	Capacitor 2500 Mfd, 200 VDC	Sprague #32D1201K	C1	7000.411-9
					1	Choke Assy.	Warren Mfg. Co.	L1	2913.30-1
					1	Resistor 1500Ω, 25W	Ohmite #0206	RB	6021.25-20
					1	SCR & Diode Assy.	Warren Mfg. Co.		2913.21-1
		2			2	Diode	Westinghouse 304H	D1A, D1B	9001.2-6
		1			1	Pulse Transformer Assy.	Warren Mfg. Co.	TR800	2725.32-1
		2			2	Silicon Controlled Rectifier	Westinghouse 2N1776	SCR1A & SCR1B	9001.22-8
					1	Transient Suppression Bd. Assy.	Warren Mfg. Co.		2913.23-1
					1	Capacitor 0.1 Mfd, 200VDC	Goodall, 620M Series	C10	7001.602-13
					1	Resistor 220Ω, 2W	IRC, Wirewound Type BWH	R10	6029.200-72
					1	Terminal Block	Cinch-Jones #5-140	TB1	4.644-5
					1	Transformer Assy.	Warren Mfg. Co.	TR1	2913.29-1
					1	Cabinet	Warren Mfg. Co.		2913.38-1



QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	ITEM NO

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES

FRACTIONS	DECIMALS	ANGLES
±	±	±

MATERIAL:

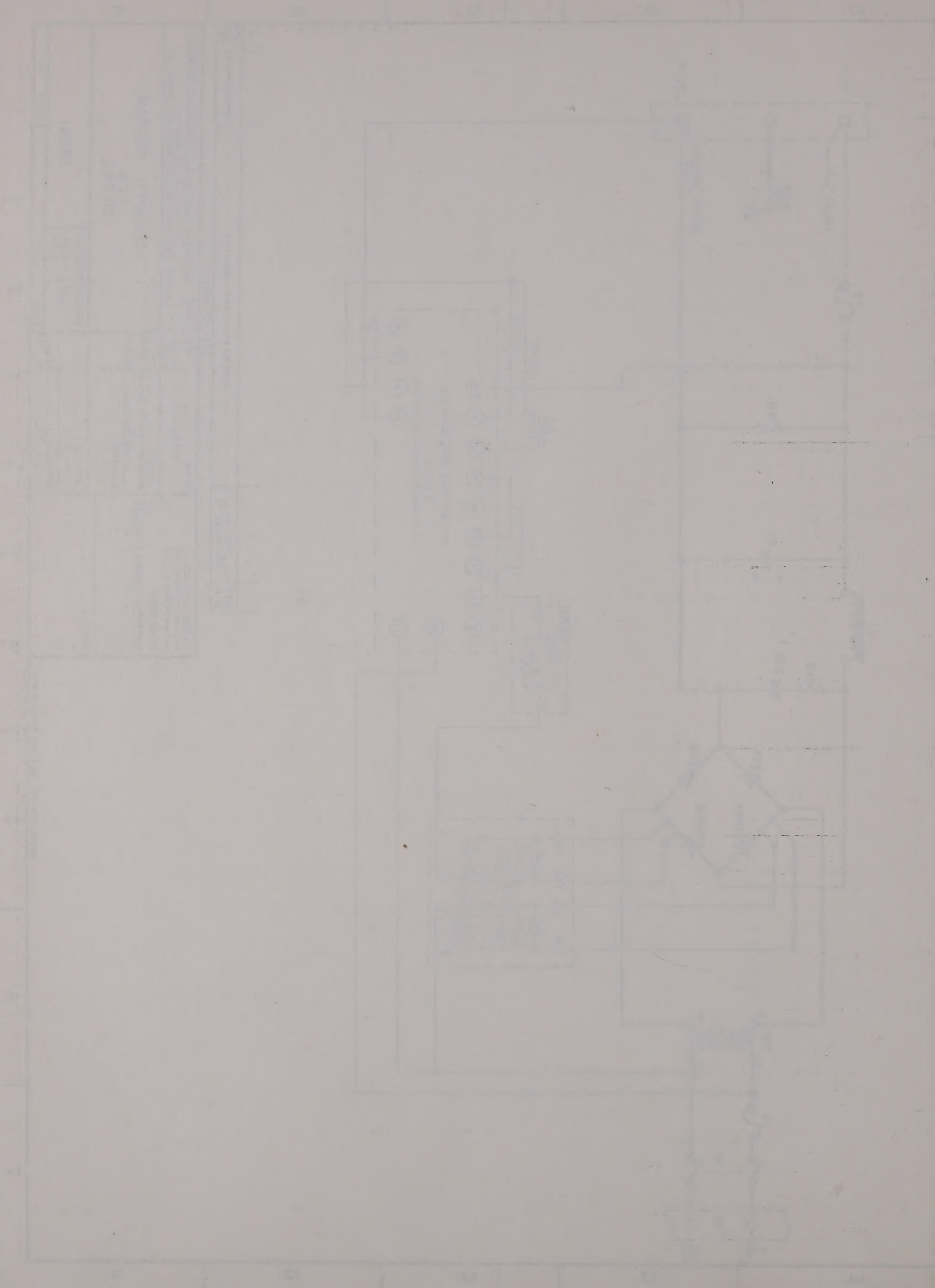
DRAWN	R PAAKKI	DATE 3-22 65
CHECKED	KEN RICHARDSON	3-27-65 3-30-65
ENGINEER		
APPROVED		
APPROVED	C J Kieffer	4-30-65

THE WARREN MANUFACTURING COMPANY
LITTLETON, MASSACHUSETTS
A DIVISION OF DIELECTRIC PRODUCTS ENGINEERING COMPANY, INC.

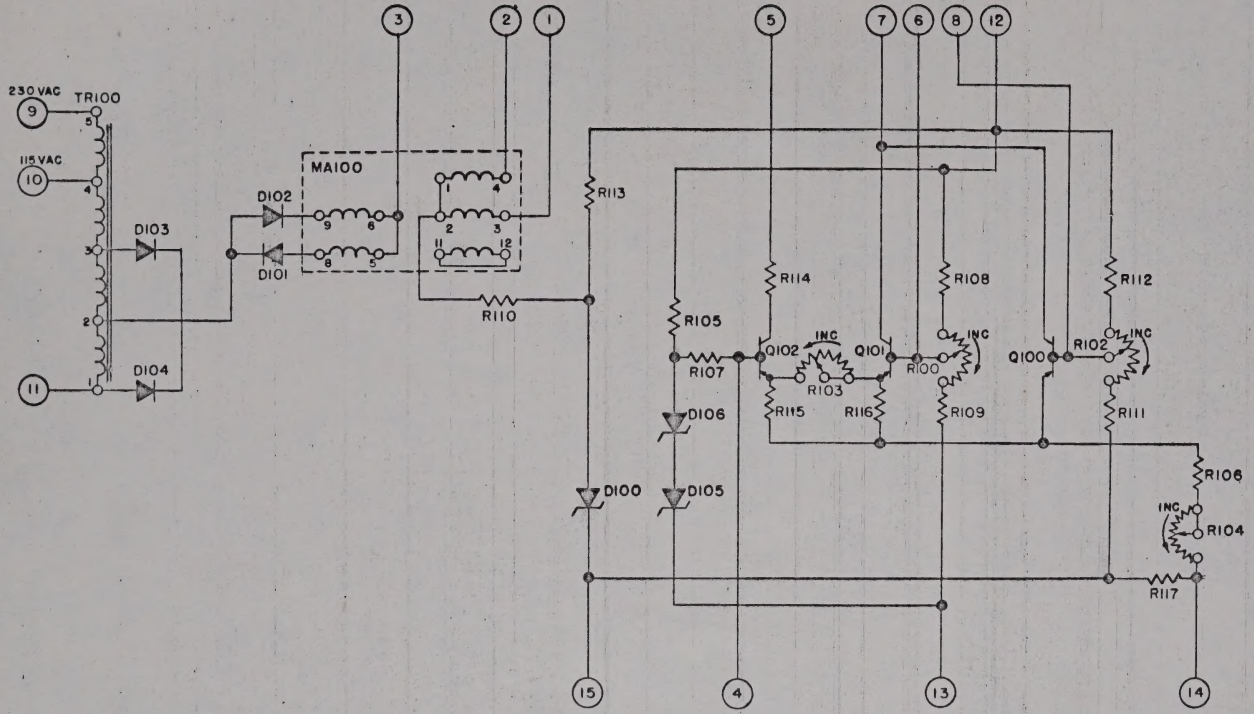
SCHEMATIC DIAGRAM FOR 130 PS2

CODE IDENT. NO	SIZE	
39314	C	2913.1
SCALE	WT	SHEET OF

UNLESS SPECIFIED TOL'S ARE BEFORE PLATING



SYM	ZONE	DESCRIPTION	DATE	APPROVED
B		SEE "A" SIZE SHEET		



QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	ITEM NO

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
FRACTIONS ± DECIMALS ± ANGLES ±

MATERIAL:

UNLESS SPECIFIED TOL'S ARE BEFORE PLATING

DRAWN	R PAAKKI	DATE 3-22-65
CHECKED	KEN RICHARDSON	3-27-65
ENGINEER		3-29-65
APPROVED		
APPROVED		9-20-65

THE WARREN MANUFACTURING COMPANY
LITTLETON, MASSACHUSETTS
A DIVISION OF DIELECTRIC PRODUCTS ENGINEERING COMPANY, INC

SCHEMATIC DIAGRAM TB100
PRE-AMP BOARD

CODE IDENT. NO	SIZE	
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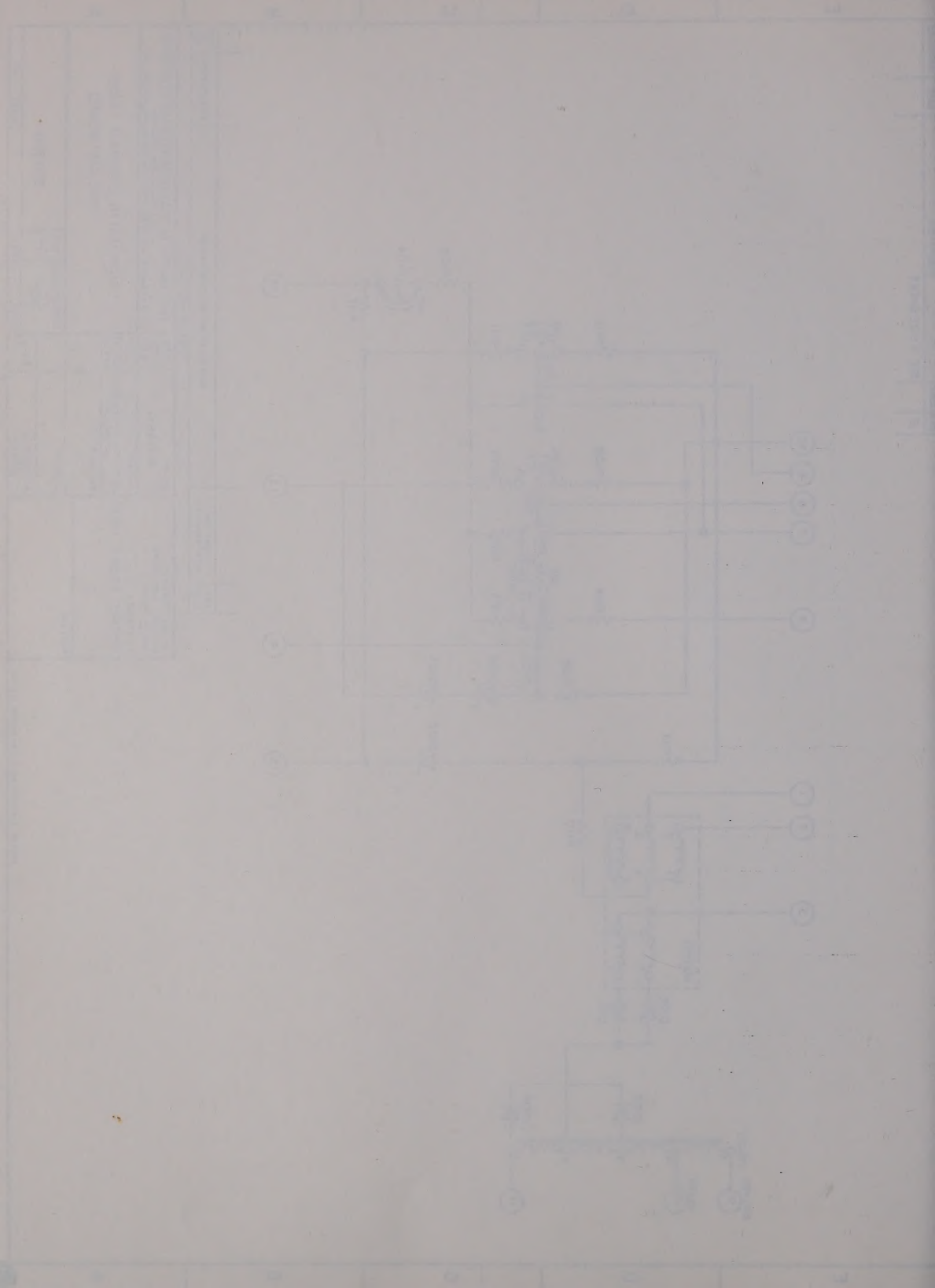
SCALE | WT | SHEET OF